

# Swan Mortality Due to Certain Heavy Metals in the Mission Lake Area, Idaho

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## BACKGROUND

A great deal has been written in the past few decades about waterfowl mortality due to heavy metals. Most of these studies were concerned with poisoning from lead shot either directly introduced into the flesh of these birds or having been ingested in the form of spent lead shot picked up from the bottom of lakes and streams as feed or grit (ROSEN & BANOWSKI, 1959; COBURN & METZLER, 1952; BENSON, et al. 1974; ADLER, 1965; CHUPP & DALKE, 1964; TRAINER & HUNT, 1965). Incidents of swan mortality related to heavy metal poisoning were reported to occur in lower Coeur d'Alene river valley in northern Idaho as early as 1924 (CHUPP, 1956). Studies conducted by CHUPP (1956) and by CHUPP and DALKE (1964) indicate that this mortality of swans and other waterfowl is due to the contamination of the Coeur d'Alene valley by mine wastes from the Coeur d'Alene mining area. The present report concerns analysis of 13 swans found dead in the Mission Lake area between Kellogg and Coeur d'Alene, Idaho in the lower Coeur d'Alene river valley.

## MATERIALS AND METHODS

The swans, *Olor columbianus*, were all collected by an employee of the Idaho Fish and Game Department during June 1974. All of the birds were autopsied and samples of tissue taken, appropriately identified, and frozen until they could be analyzed by the laboratory. Radiographic analysis of gizzards revealed lead shot in only two birds. Analysis of radiographs from these two birds indicated that one had picked up lead shot as feed or grit and the other had lead shot implanted in the area of the gizzard muscle.

## ANALYTICAL PROCEDURES

Approximately one gram (wet weight) of each tissue specimen was transferred to a teflon vessel (Uni-Seal Decomposition Apparatus) (Anon. Analytical Methods for Atomic Absorption Spectrophotometry, 1966). Five ml nitric acid was added and the vessel was then sealed and heated to 150° C. for 30-60 minutes. It was then removed from the oven and cooled to room temperature. The contents were subsequently removed, the vessel rinsed and the contents diluted with distilled water to an appropriate volume.

The digested samples were analyzed on a Perkin-Elmer Atomic Absorption Spectrophotometer, Model 303. The analytical parameters used were those specified in the manual of that instrument for each metal measured (HENDEL, 1973).

## RESULTS AND DISCUSSION

Results of analysis for lead in the various tissues of thirteen swans are shown in Table 1. The highest lead level was found in the spleen tissue of swan no. 5. The mean levels in bone was 40.38 ppm. All of the swans tested had significant lead levels in bone with the exception of swan no. 5. The mean level in liver tissue was 23.31 ppm and all birds showed liver values of 7 ppm or greater.

TABLE 1. Lead Levels in Tissues from Thirteen Swans Found Dead in the Mission Lake Area of Idaho

	1	2	3	4	5	6	7	8	9	10	11	12	13	Range	$\bar{X}$
<u>Tissue</u>															
Bone	45	32	33	22	44	27	39	<1	55	60	94	37	37	<1-94	40.38
Brain	2	39	<1	<1	14	17	<1	4	14	6	<1	3	15	<1-39	8.92
Feathers	16	24	84	10	29	74	43	21	16	10	<1	26	10	<1-84	27.92
Flesh	-	8	73	<1	<1	2	<1	3	4	7	15	9	-	<1-73	11.00
Heart	14	-	<1	20	9	24	<1	<1	28	<1	3	4	<1	<1-28	8.67
Kidney	-	-	16	-	-	54	-	113	37	23	16	57	-	16-113	45.14
Liver	17	33	21	22	35	15	17	22	29	11	43	31	7	7-43	23.31
Spleen	109	86	-	57	185	-	10	-	-	-	-	-	<1	<1-185	74.50

As indicated by TRAINER and HUNT (1965) lead poisoning of swans is not a simple one-cause disease but is influenced by a number of ecological factors including weather, water levels, soil and diet.

According to CHUPP and DALKE (1964) swan mortality was reported in the lower Coeur d'Alene river valley as early as 1924. This mortality has continued with increasing incidence to the present. Analysis reported by CHUPP and DALKE (1964) revealed that swans in this area probably died from heavy metal poisoning and there was little doubt that lead pollution of lakes and rivers came from the local mines and smelters. CHUPP (1956) showed that aquatic plants and cultivated oats from the area of their study revealed large amounts of lead and ELLIS (1940) recorded 0.3% to 0.08% in the surrounding soil incrustations near this same study area.

It would appear that lead levels in this study are high enough in themselves to account for the death of these birds. ROSEN and BANOWSKI (1959) made the following statement about ascribing death of waterfowl due to lead poisoning, "It is difficult to describe pathological lesions of lead poisoning in waterfowl. They are not consistent because there is variation in the amount of lead ingested which may result in an acute or chronic toxicity, or any of the stages in between." It is interesting to note that in the lower Coeur d'Alene river valley of Idaho by far the greatest incidence of deaths occurs during the spring months when waters are at their lowest level and, as a consequence, the aquatic vegetation upon which the swans feed is more exposed.

In this study, swans dying in the Mission Lake area in the spring of 1974 exhibited typical signs associated with lead poisoning. The residues in the bones of these birds was indicative of chronic exposure (BENSON, et al. 1974). The levels were equal to or higher than that reported by BAGLEY, LOCKE and NIGHTINGALE (1967). The swans were emaciated. The gizzards and proventriculi were enlarged in all cases. As a result of this condition starvation would be suspected; however, this would not account for the general condition of the gall bladder and other findings. In addition, a fairly common observation in swans that died from lead poisoning is a blue-gray or greenish cast of the intestinal tract which is indicative of the presence of lead sulfide. This condition was found in these birds and a similar discoloration was observed in the liver and kidney. One of the most pronounced findings was the intense greenish staining of the gizzard lining which, in some cases, extended into the proventriculus. The feces were all green and watery resulting in the greenish discoloration of the feathers about the vent.

Only one bird had lead shot in the gizzard indicating that these birds did not die from ingestion of pellets. In view of these findings, it appears that high lead levels were related to ingestion of vegetation which was contaminated with lead. The results also suggested that ingestion of lead contaminated vegetation was probably the cause of death in the thirteen swans tested.

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